MODEL 462

SWEEP GENERATOR

OPERATIONAL MANUAL

KIKUSUI ELECTRONICS CORP.

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1. GENERAL

Kikusui Electronics' Model 462 is an electronic sweep generator having a frequency range from 20Hz to 200kHz without switching range switch. Futhermore sweep frequency range can be expanded from 2Hz up to 200kHz, if frequency offset is adjusted at the lowest frequency. Sine wave output can be obtain from a terminal on the frontpanel, fixed sine and triangular wave are available from the rear panel.

Model 462 has two logarithmic sweep mode, one is automatically repetitive sweep, the other is manual trigger start-stop mode. In start-stop mode, when the equipment is triggerd by a manual switch, oscillation start at the lowest frequency and stop at the highest frequency.

Also VCG'(VOLTAGE CONTROL GENERATOR) frequency is proportional to input applied voltage, maximum frequency 200kHz can be obtained at maximum 10V input voltage.

The repetition rate of the sweep generator can be varied continuously within a range of 0.1 to 100 sec. Considering the automatic frequency measurement, Model 462 is provided with timebase output terminal for connecting an oscilloscope or X-Y recorder on the rear panel.

As described above, Model 462 can be widely applied to many types of mesurement and tests such as frequency response test of audio amplifiers, filter chracteristic mesurement, FM signal source test or sound/vibration test as a voltage control generator, sweep generator or function generator as well as an ordinaly generator.

2. SPECIFICATIONS

Oscillation mode	1. VCG (Linear)
	2. Continuos Sweep (Logarithm)
	3. Manual Trigger Sweep (Logarithm)
	4. Dial
Frequency range	2Hz to 200kHz
Dial scale	2Hz to 200kHz; divided in nearly geometric ratio
Frequency Offset	8% (When offset is adjusted)
	Approx. ±20Hz (Adjustable less than 2Hz with the knob)
Frequency stability	Within ±0.5% against ±10% fluctuation of power voltage
Output waveform	Sine-wave
	Triangular, Square wave (Fixed output, max. 10Vp-p, from the terminal on Rear Panel)
Maximum open output voltage	More than 30Vp-p
Output impedance	600Ω ±20%
Amplitude stability	Within ±0.5% against ±10% fluctuation of power voltage
Frequency characteristics	Within ±0.3dB at 1kHz
Distortion factor	Less than 1% within 20Hz to 60Hz
	Less than 0.6% within 60Hz to 70kHz
	Less than 1.5% within 70kHz to 200kHz
Repetition period of time base	0.1 sec. to 100 sec. (Sweep width 10,000)
Ranges	0.1sec.~1sec., 1sec.~10sec., 10sec.~100sec.
Sweep range	20Hz to 200kHz (Dial used)
	Less than 2Hz to 200kHz (Adjustable frequency offset)

VCG

Control frequency range	2Hz to 200kHz
Control voltage	0 to +10V
Input frequency range	DC to 2kHz
Time base output	0 to 10V peak
Sync output	More than -10V peak
Pulse width	Less than 2μsec.
Power requirement	100V, 50/60 Hz, approx. 12.5 VA

Dimensions	200(W) x 140(H) x 330(D) mm
(Maximum dimensions)	200(W) x 160(H) x 420(D) mm

Accessories	Operational manual

3. OPERATION

3-1 Front panel descriptions

1) POWER — Power pushbutton switch. When pushed and locked. Power is on and the Pilot lamp lights to indicate a ready state.
If high accuracy is needed, warm up time is required for 30 minutes, because the circuits employed thermal oven for stabilizing an Anti-log converter circiut.

2) MODE LINEAR — Variable frequency mode switch to select VCG operation, sweep (continuous, manual trigger) and dial depending upon the application.

*VCG — In VCG mode, oscillation frequency can be controled by external applied voltage, and relationship between frequency and applied voltage is proportional.
For a example, when applied voltage is +10V, frequency is 200kHz. If 20kHz frequency is required, applied voltage is +1V.

*SWEEP CONT (LOG) — When the equipment is used for continuous sweep operation, select this position. Slope variable frequency is logarithmic.

*MANUAL TRIG For manual operation of sweep run up or run down, set this position of the Mode switch When manual trigger switch is set at Down position, the equipment oscillates at the frequency which is set by the frequency dial. Then if Trigger switch is set at up position, run up sweep start, and stop at the upper frequency which is set by the upper frequency dial. Reverse operation of above mention means run down sweep from upper frequency to lower frequency.

*DIAL When the frequency is controlled by the dial (lower frequency dial), This position should be set.

3) VCG INPUT VCG input terminal used when the oscillator frequency is controlled by an external voltage. When the input voltage increases from +10mV to +10V, the oscillation frequency increases up to 100,000 times.

4) LOWER FREQ (DIAL) Lower frequency dial in the sweep mode. When turns it clockwise, the oscillation frequency increases.
In case of continuous oscillation mode, use this dial for setting the frequency.
In VCG mode of operation, dial control circuit is cut off.

5) UPPER FREQ

Upper frequency dial in the sweep mode. When turns it clockwise, the oscillation frequency increases.
In VCG mode of operation, dial control circuit is cut off.

6) FREQ OFFSET

Offset control of oscillation frequency is calibrated at the center position, can be adjust frequency within ±20Hz.

7) SWEEP STOP

Sweep state indicator lighting shows sweep stopped or finished for reference of manual mode of operation.

8) SWEEP TIME

A control knob of the sweep repetition rate from 0.1~100 sec. is divided in 3 decade range: 0.1~1sec.,1~10sec.. 10~100sec. Fine control provides inter-range adjustment.
Clockwise rotation increases repetition rate. At the fully clockwise rotation repetition rate is calibrated.

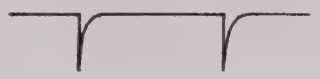
9) OUTPUT

Control knob of output voltage.
Clockwise turning increase s the output voltage. With no load, more than 30Vp-p is obtained: When the output terminal is terminated with 600Ω, more than 15Vp-p.
A BNC type receptacle located below this knob is the output terminal.

3-2 Rear panel descriptions

1) SYNC OUTPUT

The sync pulses obtained at this terminal synchronize with the negative peak of the sine-wave or the positive peak of the triangular-wave or the full of the square-wave, which are taken out at the OUTPUT terminal.

Sync pulse 

Sine-wave

Triangular-wave

Square-wave

2)

Output terminal for Square-wave. fixed 10Vp-p can be obtained and output resistance is 600Ω.

3)

Output terminal for triangular-wave. fixed 10Vp-p can be obtaind and output resistance is 600Ω.

4) TIME BASE OUTPUT

Time base output voltage can be obtained from this terminal used for observing frequency characteristic curves on oscilloscope or recording response by X-Y rcorder. So output voltage is proportional to oscillation frequency with 600Ω output resistances.

5)	SWEEP STOP SIG OUTPUT	Sweep stop signal provides for pen-up operation of X-Y recorder recording characteristics curves. Output voltage is 0V during sweeping , +10V output resistance approx. 1kΩ at the stop state.
6)	FUSE	Used for AC power line, 0.5A rated.
7)	Power Cord	Connected to 100V AC , 50/60 Hz

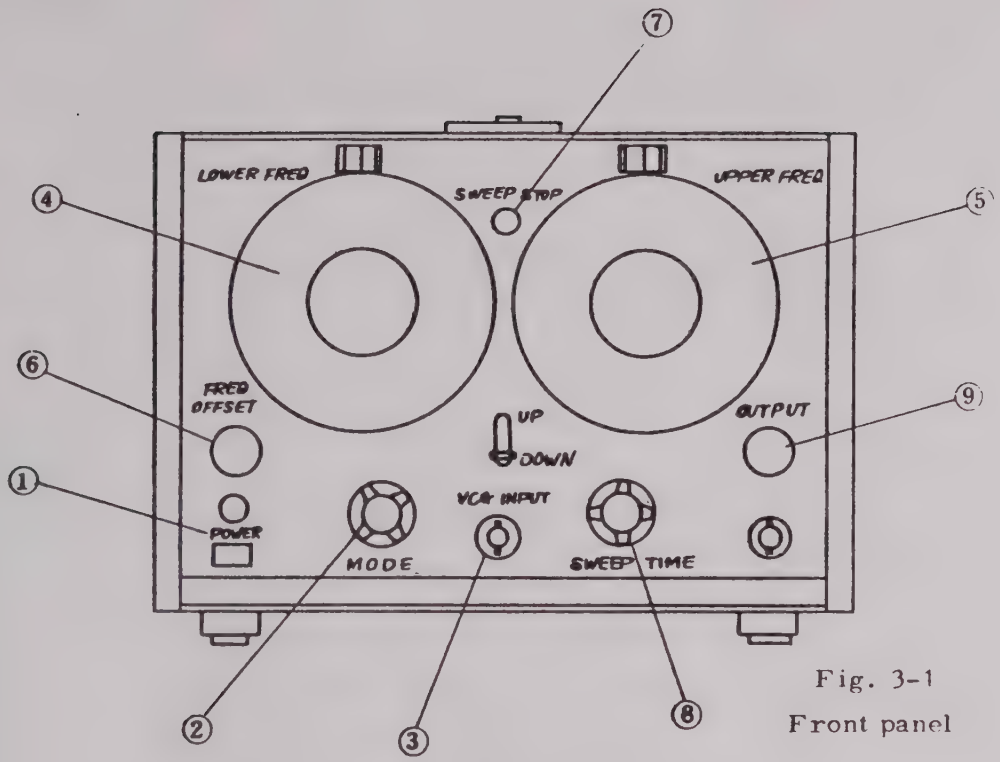


Fig. 3-1
Front panel

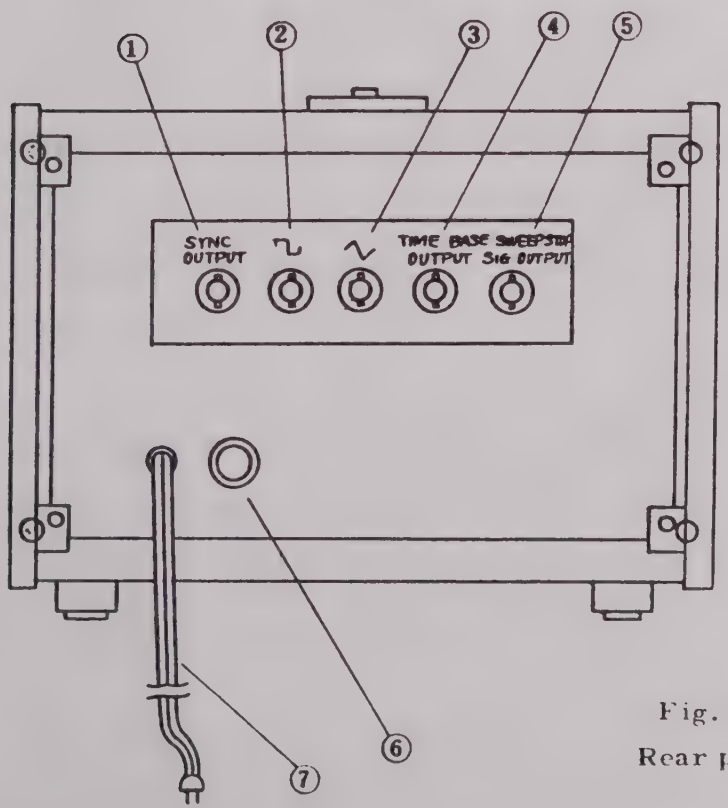


Fig. 3-2
Rear panel

3-3 Applications

Model 462' field application is considered great many, but we show here fundamental applications to master how to use it.

Example (1) To sweep frequency from 200Hz to 20Hz with repetition rate of 1sec.

Procedure

1. Set a position MODE switch to SWEEP CONT
2. Turn the SWEEP TIME switch to the 1-0.1sec. position and adjust the VARIABLE knob to be 1sec.
3. Set the LOWER FREQ dial to 200Hz
4. Set the UPPER FREQ dial to 20kHz
5. If accurate upper or lower frequency is required, Connect frequency counter to output terminal of Model 462, and set MODE switch to the MANUAL TRIG SWEEP. Set the trigger switch to LOWER position, adjust lower frequency with frequency counter. In adjustment of upper frequency, set the switch to upper position.

Example (2) Observation of frequency response of amplifier on oscilloscope with sweep signal from 2Hz to 200kHz, repetition rate 10sec. (vertical axis is used as a amplitude. horizontal used as a frequency)

Procedure

1. Set the MODE switch to SWEEP CONT
2. Turn the SWEEP TIME switch to the 10-100sec. position and turn the VALIABLE knob 1sec.

3. Set the LOWER FREQ dial to 20Hz

4. Adjust FREQ OFFSET knob of the Model 462 to oscillate at 2Hz

5. Set the UPPER FREQ dial to 200kHz

6. If accurate upper or lower frequency is required, connect frequency counter to output terminal of Model 462, and set MODE switch to the MANUAL TRIG SWEEP.
   Set the trigger switch to LOWER position, adjust lower lower frequency with frequency counter.
   In adjustment of upper frequency, Set the switch to upper position.

7. Connect Model 462, the oscilloscope and the amplifier to be mesured as shown in Fig. 3-3

8. Set the vertical sensitivity range of the oscilloscope according to the output voltage level to the amplifier and set the horizontal axis to the external input terminal.
   Since the output voltage at the TIME BASE OUTPUT terminal is 0 to 10V , adjust the horizontal sensitivity of the oscilloscope so that the desired trace is obtained on the CRT screen.

9. If the amplifier has such a response that the amplitude at a 200kHz is reduced 6dB with respect to that at 2Hz, the amplitude at 200kHz of the waveform displayed will be approx. one half that at 2Hz as shown in Fig. 3-4

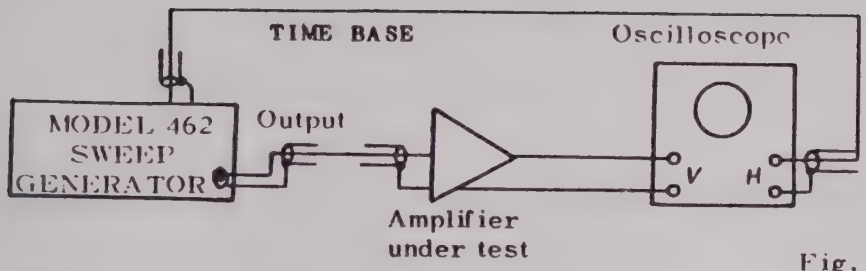


Fig. 3-3

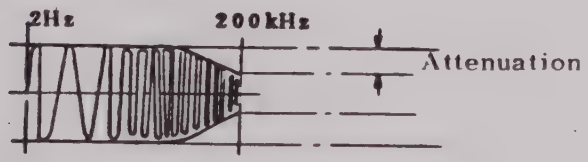


Fig. 3-4

Example (3) Recording frequency response of an amplifier under test on X-Y recorder with sweep range from 20Hz to 500kHz, repetition rate 20sec.

Procedure

1. Set the MODE switch to MANUAL TRIG SWEEP position
2. Set the SWEEP TIME knob to 100 to 10sec., and adjust VARIABLE knob of the Model 462 to be 20sec.
3. Set the LOWER FREQ dial to 20Hz
4. Set the UPPER FREQ dial to 50kHz
5. Connect a terminal of time base output located on the rear to an X-axis input terminal of the recorder.
6. Feed the output voltage of the Model 462 to the equipment under test, and convert AC signal output of the equipment to DC voltage by AC-DC converter. Converted DC voltage is applied to the Y-axis of the recorder.

7. Throw the MANUAL TRIG switch to up or down, then Model 462 start run-up or run-down sweep.

Example (4) Control oscillation frequency from 20Hz to 200kHz with external control voltage.

Procedure

1. Set MODE switch to VCG position
2. Application of control voltage +1mV to +10V is equivalent to oscillate the frequency 20Hz to 200kHz.
3. If AC voltage is used as control voltage, connect a regulated DC sourse in series with the control voltage source in order to prevent the control voltage to be negative.
   If the voltage is negative, the equipment does not operate.

DRAWING NO. 39304

MODE SWITCH

TO TIME BASE A

MODE SWITCH B

+12V

-12V

+22V

MC1 741

MC2 TA7049M

MC3 741

MC4 741

MC5 741

ZSA495 Y

ZSC372 Y

ZSK123 (PAIR)

ZSK43 Y

2SC372 Y

2SK23A

15953 or 1S1586

RD7A

RPK4 Z70Ω

T.P.

OFF SET

ZSA493 GRXZ

SWITCHING CIRCUIT

TO FLIP FLOP (F)

TO INTEGRATOR(I)

INTEGRATOR(I)

INVERTER

COMPARATOR(II)

CONTENTS

1	CR21 1S1532	5.6K	15K	6.8K	15K
2	5.6K	12K	2.2K	47μF	16WV
3	5.6K	12K	2.2K	47μF	16WV
4	5.6K	12K	2.2K	47μF	25WV
5	5.6K	12K	2.2K	47μF	25WV

KIKUSUI ELECTRONICS CORPORATION

TITLE MODEL 45Z 1/8

MAIN BOARD CIRCUIT-1

CODE NO.

DRAWING NO 39304

37106

INTEGRATOR (I)

COMPARATOR (I)

FLIP FLOP

C16 0.001μF (2%)

+12V

-12V

TO SWITCHING CIRCUIT

b'

Q1, Q2 2SK12Y ×2 (Pair)

Q3 2SA495 ⓎY

Q4 2SC372 ⓎY

Q5 2SA495 ⓎY

R1 3.9K, R2 3.9K, R3 15K, R4 15K, R5 10Ω, R6 3.9K, R7 10Ω, R8 15Ω, R9 15Ω, R10 10Ω

R59 10M, R60 10K, R61 10K, R62 10K, R63 1K, R64 1K

CR1, CR2 1S953 or 1S1586

Q6 2SA495 ⓎY

Q7 2SC372 ⓎY ×2

Q8 2SA495 ⓎY

Q9 2SA495 ⓎY ×2

Q10 2SC372 ⓎY

Q11 2SC372 ⓎY

R11 6.8K, R12 1K, R13 3.9K, R14 3.9K, R15 1K, R16 6.8K, R17 1K, R18 1K, R19 1K, R20 1K, R21 1K, R22 1K, R23 3.3K, R24 3.3K, R25 10K, R26 10K, R27 3.3K, R28 3.3K

C1 200pF, C2 100pF, C3 100pF, C14 200pF

CR3, CR4 1S953 or 1S1586

Q12 2SA495 ⓎY

Q13 2SA495 ⓎY

Q14 2SC372 ⓎY

Q15 2SC372 ⓎY

R29 6.8K, R30 6.8K, R31 15K, R32 15K, R33 15K, R34 15K, R35 6.8K, R36 6.8K

C7 100pF, C8 100pF, C9 100pF, C6 100pF

F

F̄

Q16 2SA495 ⓎY

Q17 2SC372 ⓎY

Q18 2SC372 ⓎY

Q19 2SA495 ⓎY

R37 68K, R38 5.6K, R39 5.6K, R40 3.3K, R41 1K, R42 1K, R43 1K, R44 22K, R45 15K, R46 15K, R47 68Ω, R48 22Ω, R49 22Ω, R50 68Ω

C9 5pF

CR5 1S953, CR6 1S953, CR7 1S953

SYNC OUTPUT

(-10Vp-p min)

SQUARE WAVE OUTPUT

(12Vp-p)

R56 560Ω

Q20 2SC372 ⓎY

Q21 2SA495 ⓎY

R51 68Ω, R52 22Ω, R53 22Ω, R54 68Ω, R55 10K, R58 10K, R56 100Ω, R57 100Ω

C10 100pF, C11 100pF

CR8, CR9 1S953 or 1S1586

R55 560Ω

TRIANGULE WAVE OUTPUT (12Vp-p)

4'

a'

TO COMPARATOR(II)

TO SWITCHING CIRCUIT

a' c'

C12, C13, C14, C15 16WV47μF

5' 18 2'19 1' 14' 15' 16' 17' 18'

F TO SINE SYNTHESIZER

+12V COM -12V +12V COM -12V

Unless otherwise indicated resistance is given in ohms, 1/4W.

* Adjusted in factory

KIKUSUI ELECTRONICS CORPORATION

TITLE MODEL 462 2/8

MAIN BOARD CIRCUIT-2

CODE NO

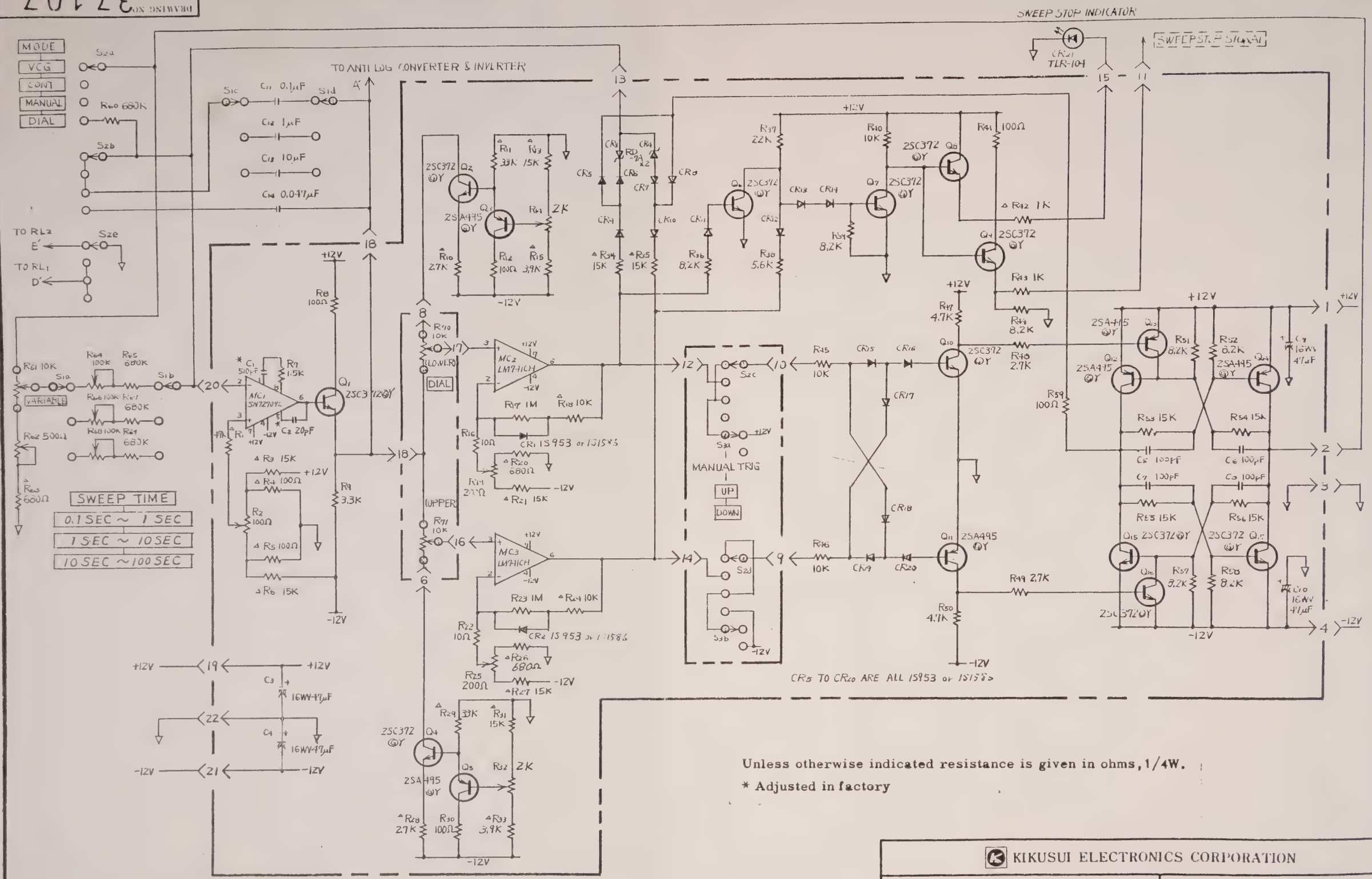
DRAWING NO 37106

R17, R22 2.2K → 3.9K

15 1/5" → 1S953 等価品 CZ0 SINE 上 M

CONTENTS

DRAWING NO 37107



Unless otherwise indicated resistance is given in ohms, 1/4W.

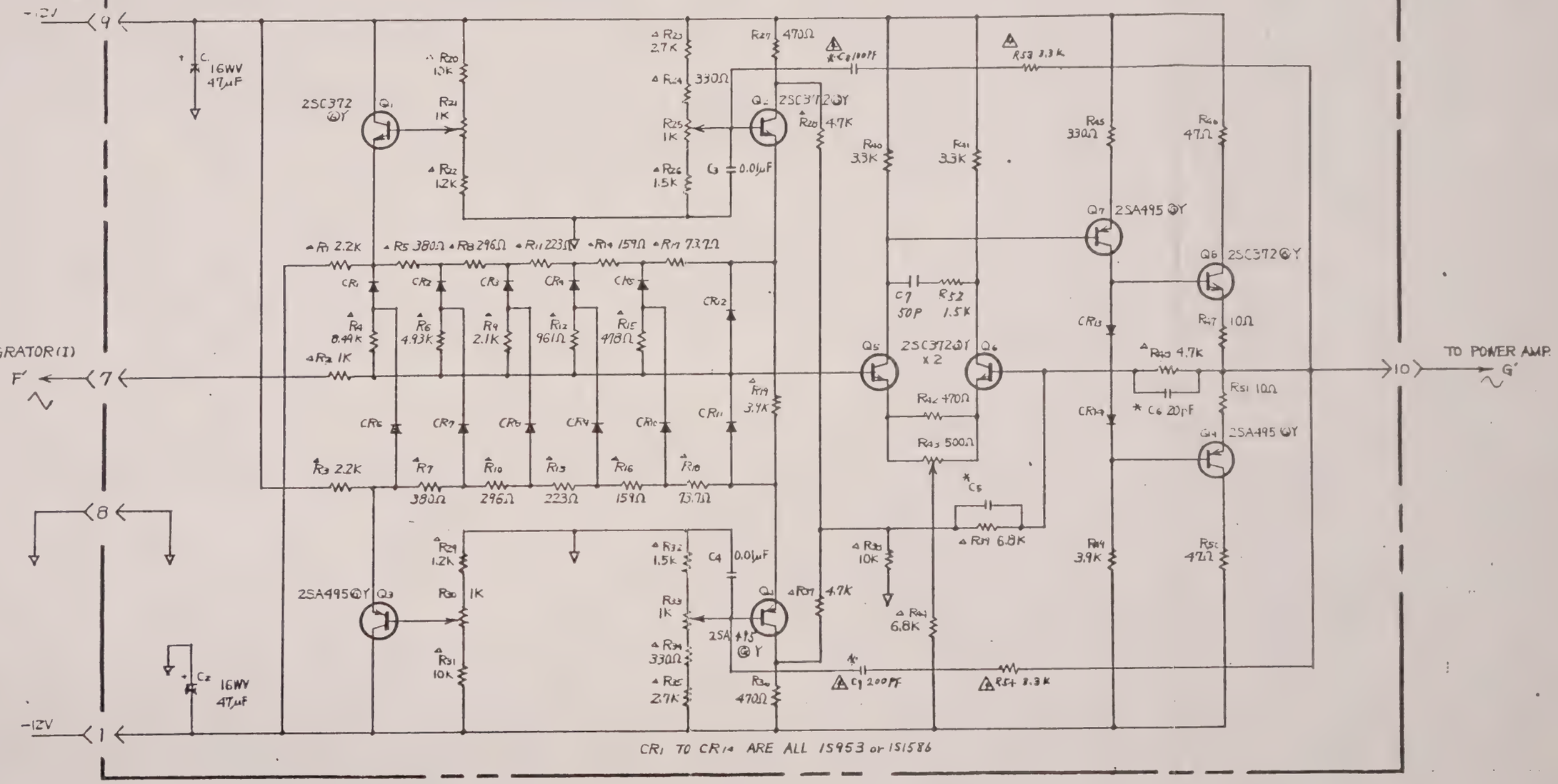
* Adjusted in factory

KIKUSUI ELECTRONICS CORPORATION

TITLE MODEL 462 3/8 TIME BASE CIRCUIT	CODE NO
	DRAWING NO 37107

7104-KSK11

37108



Unless otherwise indicated resistance is given in ohms, 1/4W.

*** Adjusted in factory**

KIKUSUI ELECTRONICS CORPORATION

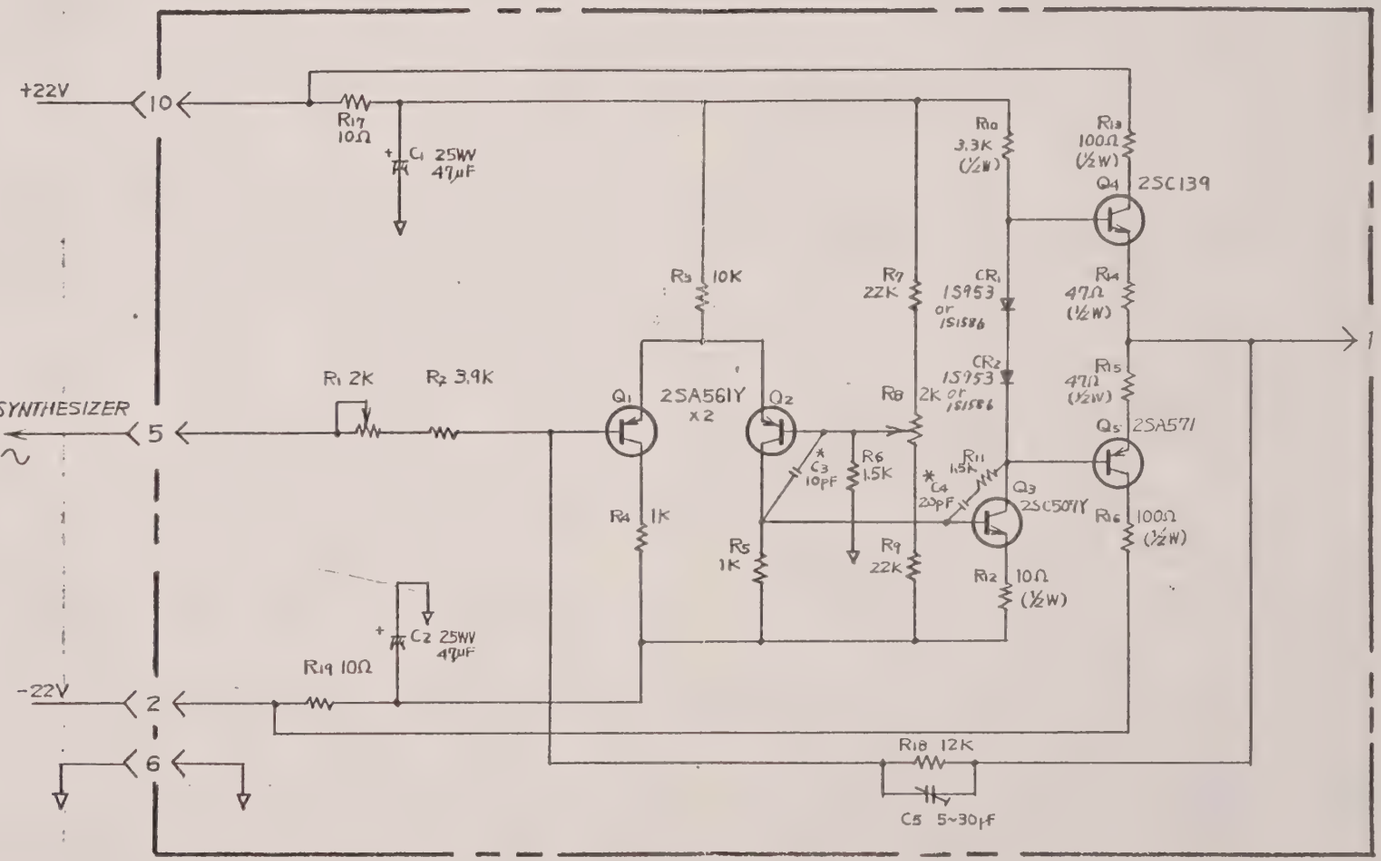
TITLE MODEL 462 4/3
SINE SYNTHESIZER CIRCUIT

CODE NO

DRAWING NO 37108

CONTENTS | REV BY | APP BY | DATE

DRAWING NO. 37109



Unless otherwise indicated resistance is given in ohms, 1/4W.

* Adjusted in factory

KIKUSUI ELECTRONICS CORPORATION

TITLE MODEL 462 5/8

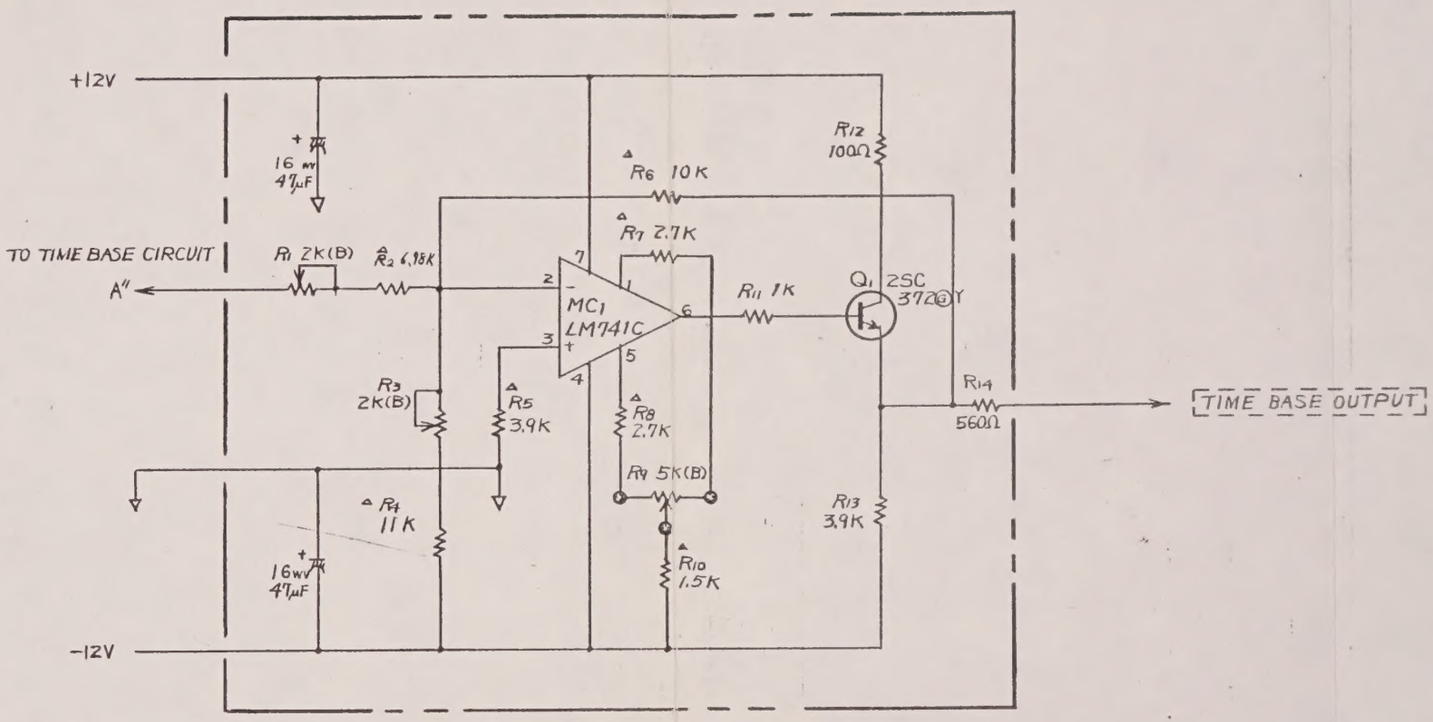
POWER AMP CIRCUIT

CODE NO.

DRAWING NO. 37109

CONTENTS | DATE | APP BY | REV BY

DRAWING NO. 37110



Unless otherwise indicated resistance is given in ohms, 1/4W.

* Adjusted in factory

DATE	APP. BY	REV. BY	CONTENTS
79. 4. 25		変19	R2 9K→6.98K, R4 14K→11K, R15 18K→3.3K 変更
79. 6. 2			R2 は 6.98K に変更
83. 9. 27			

KIKUSUI ELECTRONICS CORPORATION

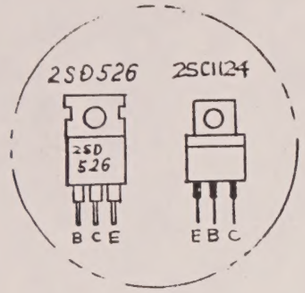
TITLE: MODEL 462 6/8 INVERTER CIRCUIT

CODE NO.

DRAWING NO. 37110

DRAWING NO. 37111

2SD526 2SC1124



AC25V, DC150mA

240V
230V
220V
117V
110V
100V

AC 50/60Hz

CR1 CR2 CR3 CR4 V06G x4

B' TO OVEN

C'

C1 50WV 220μF

[A]

MC1 LM723CH

Q1 2SC1124-2

R1 1Ω 3W(1%)

R5 470Ω

△R2 4.7K

R3 1K

△R4 2.2K

C3 50WV 22μF

C2 * 510pF

+22V

COM

AC25V, DC150mA

CR5 ~8 V06G x4

THE SAME CIRCUIT AS (A)

MC2, Q2, C4 ~ C6, R6 ~ R10

-22V

R19 150K

BNF-2

0

POWER

FUSE (0.5A)

AC16V, DC200mA

C9 ~ 12 V06G x4

(B)

C7 25WV 470μF

MC3 LM723CH

Q3 2SD526

R11 1Ω 3W(1%)

△R2 2.2K

R13 1K

△R14 3.9K

C9 25WV 22μF

C8 * 510pF

+12V

COM

AC16V, DC200mA

C13 ~16 V06G x4

Q4 2SD526

THE SAME CIRCUIT AS (B)

MC4, C10 ~ C12, R15 ~ R18

-12V

AC 100V 50/60Hz

Unless otherwise indicated resistance is given in ohms, 1/4W.

* Adjusted in factory

KIKUSUI ELECTRONICS CORPORATION

TITLE MODEL 462 7/8

POWER SUPPLY CIRCUIT

CODE NO.

DRAWING NO. 37111

CONTENTS | REV BY | APP BY | DATE

FT-344 for 220, 230, 240V 変更
2SC1124 → 2SC1226

DATE 4.23 | 77.7.13 | 5.9.27

APP BY 松田 | REV BY